| 01/27/2021 | By: Jeff Smith

Here Is The Correct Procedure For Setting An Optimized Idle Mixture And Speed

It's the simple items that are often the most overlooked. Nobody talks much about how to set idle mixture on a carbureted engine because – frankly it's just not very sexy. While it may seem an unimportant detail on the way to making headline horsepower, the truth is that a typical street performance engine will spend more operational time at closed throttle than at any other engine speed. So it's important this setting be adjusted properly. The benefits will more than outweigh the effort required to perform this correctly.

We will approach this story using a typical Holley four-barrel 750 cfm vacuum secondary carburetor with two idle mixture screws. If your Holley carburetor is equipped with four idle mixture screws, the procedure will be exactly the same except that the additional two screws will receive the same attention.

This is a 750 cfm Holley carburetor that we'll be using to set idle quality on a small-block Chevy on a test stand. This is a vacuum secondary 4150 style carburetor with two idle mixture screws.

To begin this process, we'll assume the engine in question is in good physical condition with no dead cylinders, no misfires, vacuum leaks, or other maladies that would affect idle quality. This also assumes a reasonable initial timing figure of at least 8 degrees Before Top Dead Center (BTDC). Engines with even mild performance camshafts often benefit from initial timing of 10 to 12 degrees BTDC.

We will also assume the engine has reached its full operating temperature and the choke is fully open. This is the only way that a proper idle mixture setting can be achieved. Do not attempt to set an idle mixture if the choke is even partially engaged. Make sure that the idle speed screw on the choke is not touching the fast idle speed cam on the choke. A vacuum gauge will also need to be connected to manifold vacuum.

Before moving forward, it's also a good idea to establish the basics around measuring idle quality. All internal combustion engines operate with a certain amount of idle manifold vacuum. This is created as a result of the demand from the cylinders working against a closed throttle. Engine vacuum can be measured in several different ways but the most common is a vacuum (negative pressure) expressed in inches of mercury ("Hg). Engine vacuum / pressure gauges are generally displayed in either "Hg or centimeters of mercury (cmHg).

Production and mild performance engines will generally idle somewhere in the range of 12 to 18 "Hg and the gauge needle will generally be stable and not bounce around. A highly erratic idle vacuum reading often indicates a problem such as a leaking intake valve or failed exhaust lobe where cylinder pressure is forced into the manifold causing the erratic needle movement. This is a major reason why it's important to ensure the engine is mechanically sound before final idle mixture adjustments are attempted.

Before starting the engine, use a small screwdriver to check the position of each idle mixture screw. Slowly turn each idle mixture screw clockwise (in) and count the number of turns until it lightly seats. Generally this will be anywhere from 1 to 2 turns out from fully seated. When seating these screws, do so gently to prevent damaging the seats in the metering block. Do this for both (or all four) idle mixture screws and set them to the same position. It's important that all idle mixture screws be adjusted the same way so that the output from the carburetor idle circuit is balanced across both idle mixture outlets. One to 1½ turns out is a typical place to start.

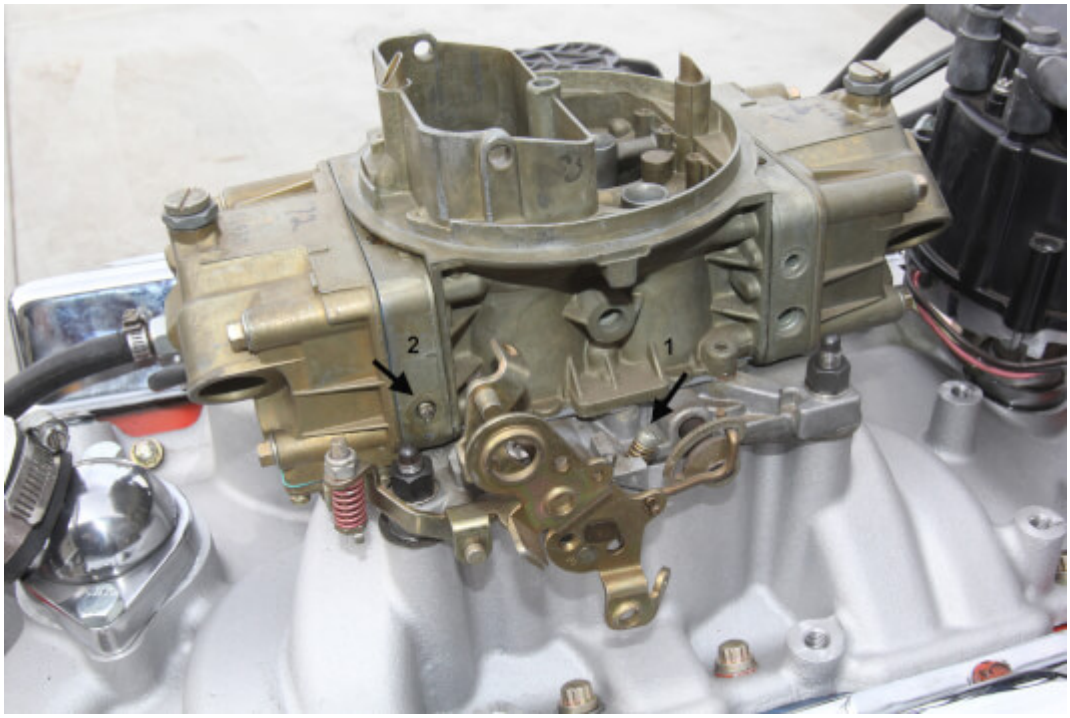
With the engine idling in Park with the emergency brake engaged, the first step is to set the idle speed at the desired rpm. Let's choose 850 rpm for this application. The curb idle is set with the idle speed adjustment screw on the primary throttle linkage on the driver side of the carburetor.

Begin by adjusting the driver side idle mixture screw in (clockwise) approximately 1/8th of a turn while monitoring the vacuum gauge. If the engine vacuum and/or engine speed increases, then adjust the passenger side idle mixture screw the same amount and monitor the vacuum reading. Repeat this process and evaluate the result. If after adjusting the first idle mixture screw the engine vacuum drops, then return to the base setting and turn the mixture screw outward roughly 1/8th turn.

This first adjustment sequence is to place the idle mixture screws on both sides of the carburetor to achieve the highest idle vacuum setting possible. If after an initial adjustment, the idle speed increases beyond the desired rpm, turn the idle speed screw counterclockwise to return the speed to the original engine speed. This will probably lower the idle vacuum reading, which is normal.

If the initial adjustment on the idle mixture screws resulted in a higher vacuum reading, then make another small movement of the idle mixture screw of no more than 1/8th of a turn. Do this on both sides of the carburetor and evaluate the result. If the vacuum drops, then return to the highest setting and see if the vacuum reading increases. This means you are

close to your final setting. Continue to make very slight changes to the idle mixture screws on both sides.



The idle speed screw (arrow 1) is located on the primary linkage. The idle metering adjustment screws (arrow 2) are located on the primary metering block on most Holley carburetors. A typical starting location for these idle mixture screws is between 1 and 1 ½ turns out from fully seated.

We've found that sneaking up on the adjustment with very small steps toward the final adjustment is beneficial. These adjustments will not be more than literally the width of the slot in the adjustment screw. These are very small changes but do have an effect on idle quality.

Moving back and forth adjusting both idle mixture screws the same for each change will eventually create the highest idle vacuum level. This should be achieved with the idle mixture screws adjusted with an emphasis toward lean settings. If turning the idle mixture screws out (richer) does not improve idle vacuum or engine speed, then the leaner setting is always the preferred choice.

At this point, have a friend sit behind the wheel and place the transmission in Drive with his foot firmly on the brakes. Monitor the vacuum gauge and

make sure the idle is stable. Placing the engine in gear will produce a slightly lower vacuum gauge reading. This is normal because a load has been applied to the engine.

Place the transmission back into Park and allow the idle rpm to stabilize. The engine should now idle at the desired idle speed with the highest manifold vacuum. Normally, this is where most adjustment recommendations end. But for an ideal idle mixture setting, a slightly leaner idle mixture is beneficial - roughly the equivalent width of the idle mixture screw slot.

What this does is make the idle mixture slightly leaner which reduces excess hydrocarbons (unburned gasoline) in the exhaust. This will tune your engine to idle a tiny bit leaner. Now it’s necessary to recheck the idle quality of the engine in gear. If the idle is unacceptable, return the idle mixture screws to the highest vacuum setting, but in most cases this slight lean setting will still support quality idle performance.

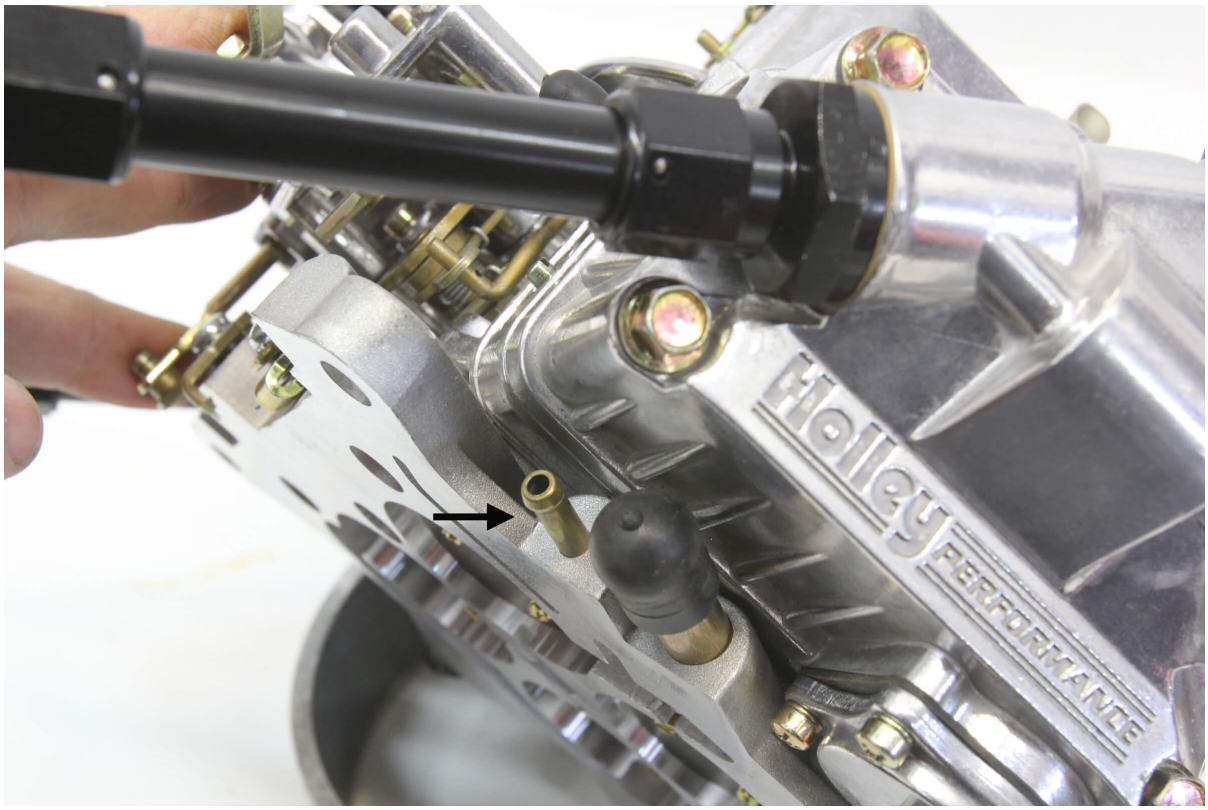
Some performance engines, especially those with idle vacuum levels of 10 “Hg or lower may not allow the engine to idle in gear and may require a much richer mixture. This is especially true if the engine is coupled with a somewhat tight torque converter. A richer idle mixture may be required in order for the engine to idle against a tight converter. Of course, this is not an ideal situation. The ideal solution is to couple this engine with a looser torque converter to reduce the load.

Another lean idle situation that can occur is a slight off-idle hesitation. In certain cases, this may not be cured with an increased accelerator pump shot. One solution might be to try a slightly richer idle mixture. It's an unfortunate but fairly common situation where street engines with long-duration camshafts with significant overlap will exhibit this off-idle hesitation and often the only way to cure it is with a richer idle mixture.

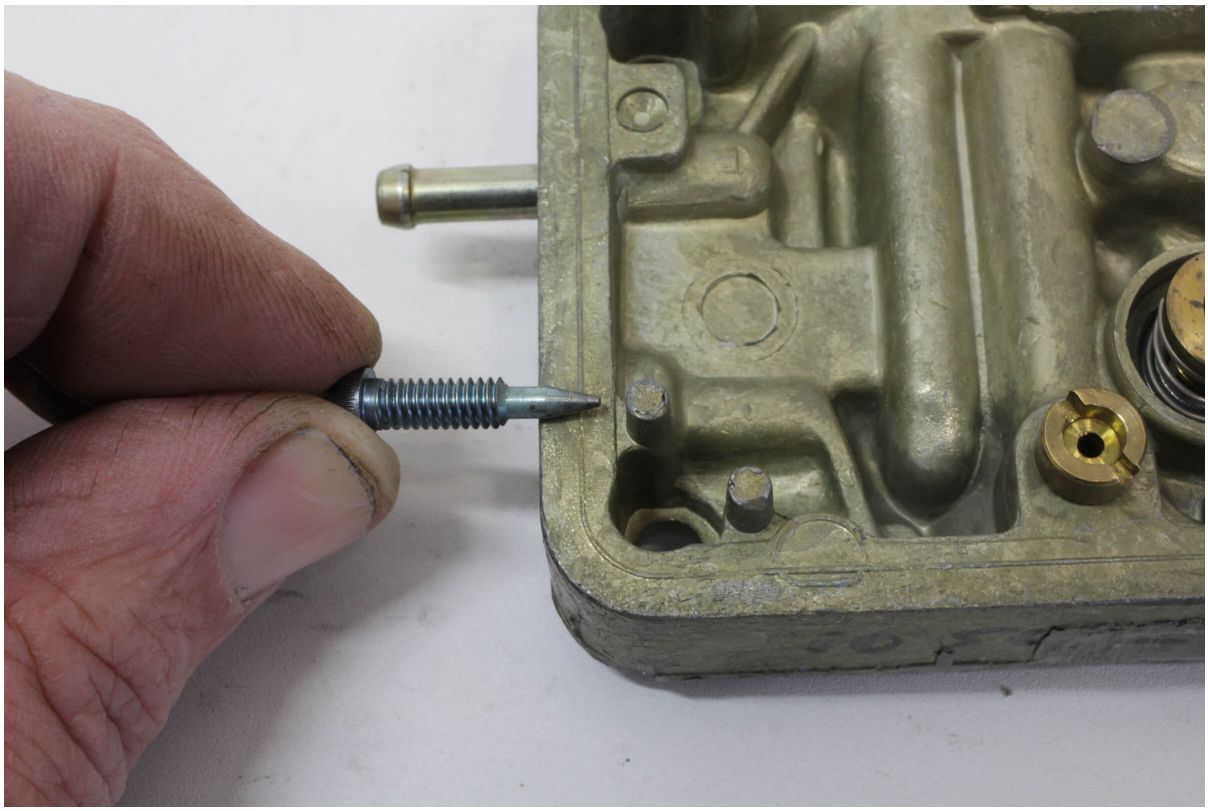
It’s worth restating that the ideal idle mixture setting can be achieved by working slowly and deliberately in search of the highest manifold vacuum

setting with very small changes to the idle mixture screws and evaluating the change. We've performed several of these processes using a sophisticated 5-gas exhaust analyzer to offer instantaneous results and have produced measurably cleaner idle quality with reduced hydrocarbon levels from very minor changes to the idle mixture screws.

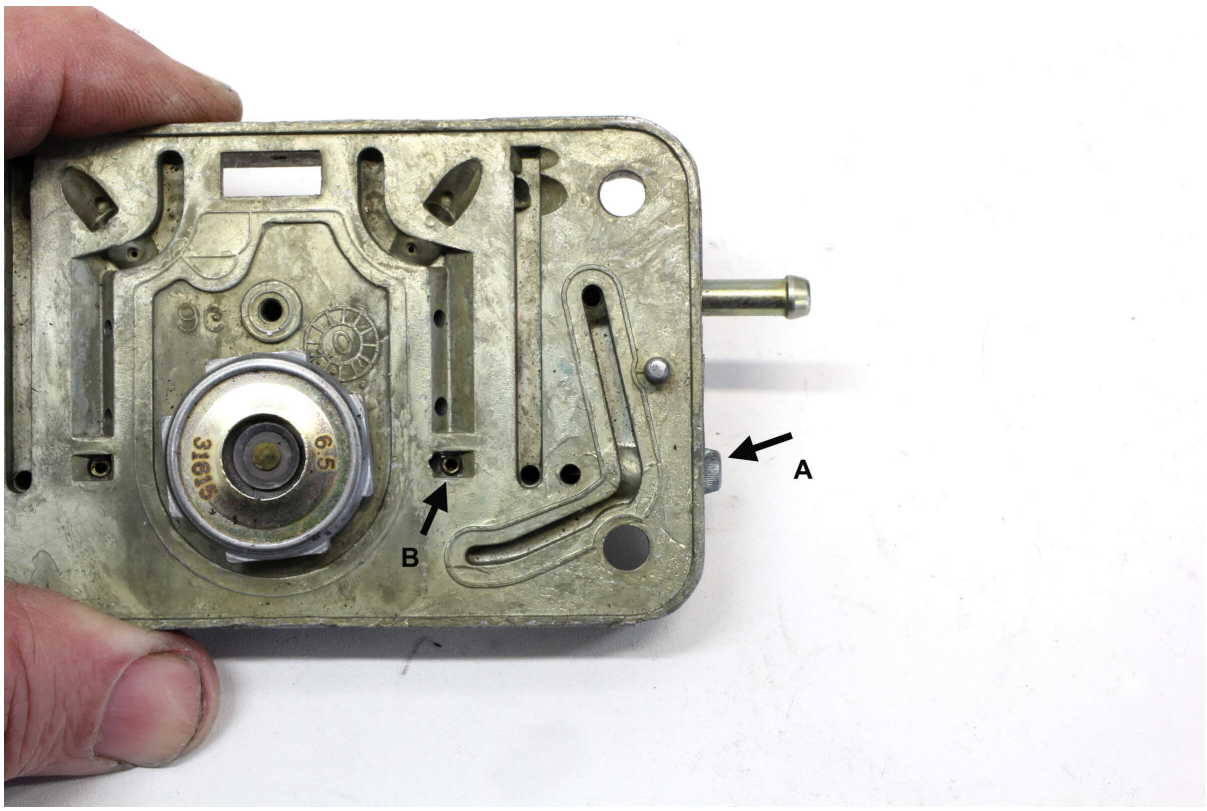
Setting a proper idle mixture won't make any more horsepower and may not bring a television news crew to your doorstep to reveal to the world how competent you are with a screwdriver. What this process will do is produce a quality idle mixture setting that will allow your engine to run sweet, clean, and true. You can save the Superman costume for later technical adventures.



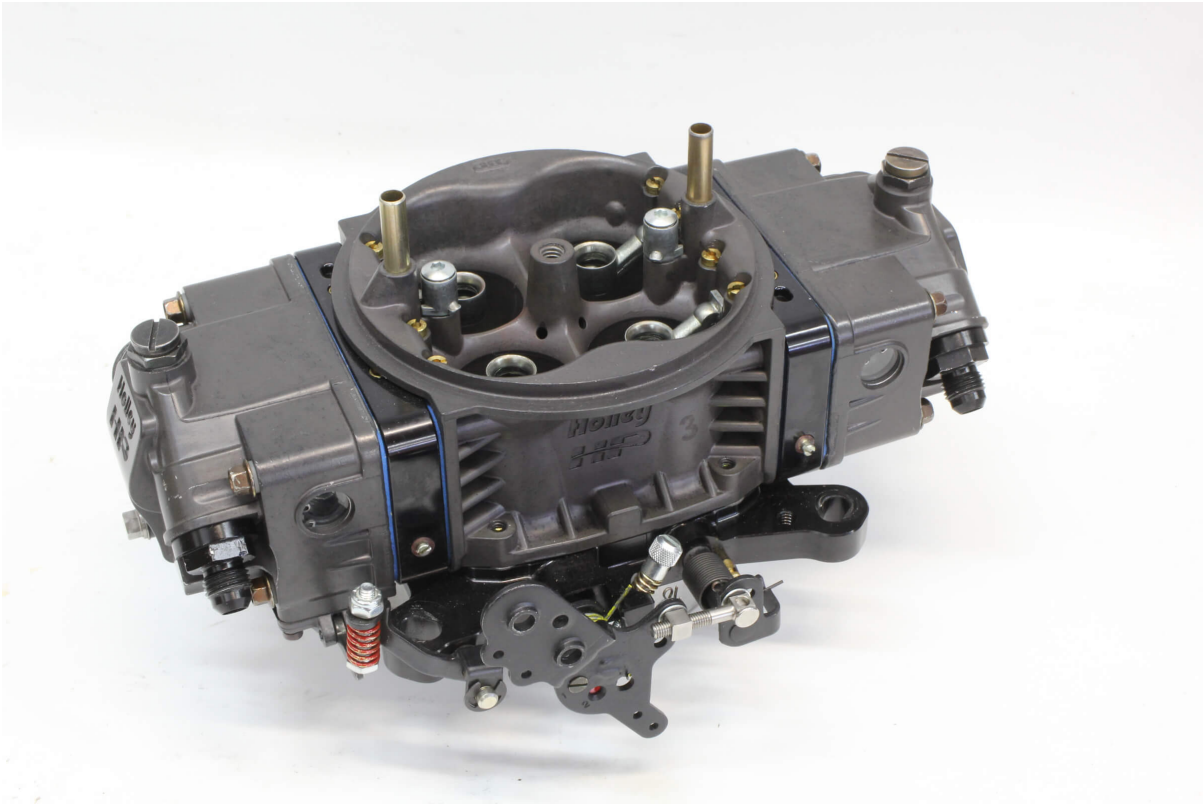
Most street Holley carburetors position the manifold vacuum port in this location (arrow) on the carburetor mounting base. Remove the plug and attach the vacuum gauge here.



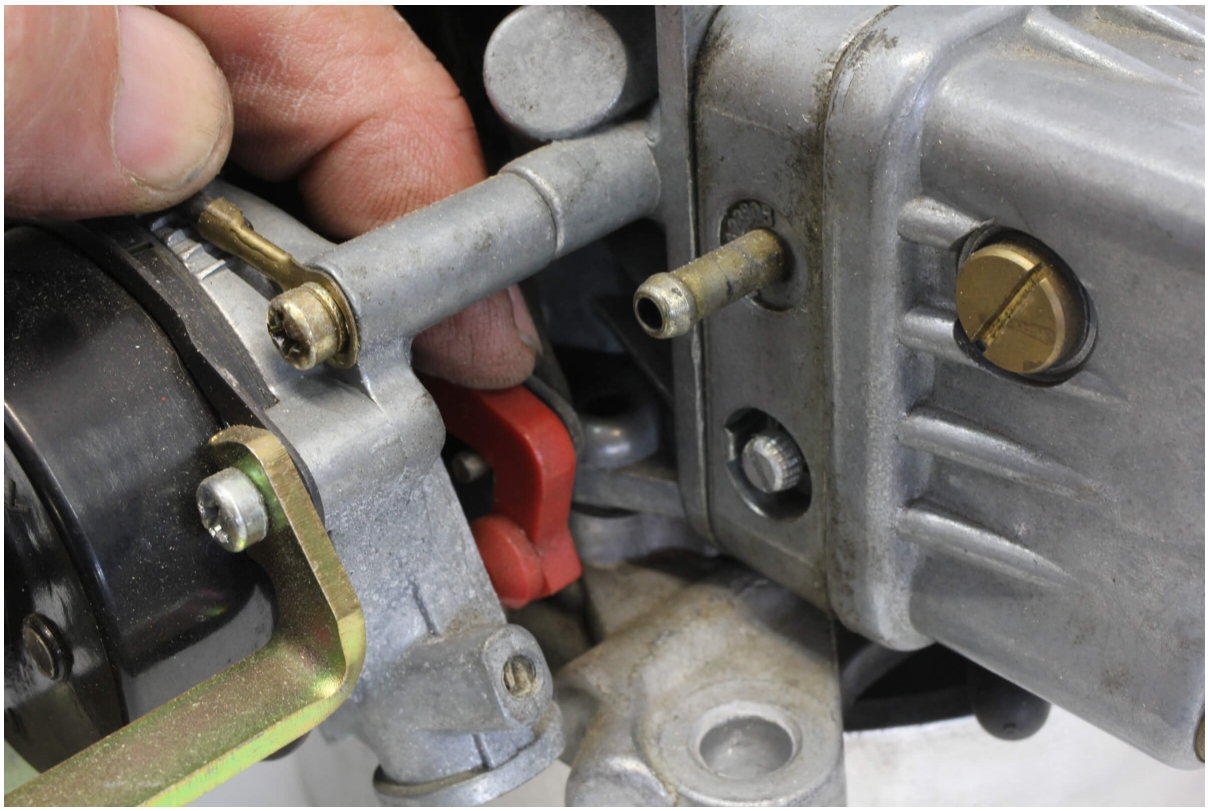
With the idle mixture screw removed, the tapered portion is what adjusts the volume of fuel allowed into the engine. Turning this adjustment screw clockwise (in) reduces the amount of fuel. Turning the screw counter-clockwise (out), increases the amount of fuel delivered to the engine.



Here, we've removed the primary metering block from the carburetor to show the idle circuit. The idle mixture screw (A) area pulls fuel from the idle feed restrictor located on this metering block at arrow B.



Many Holley performance carburetors are equipped with what is called four-hole or four-port idle mixture control. These carbs employ two more idle mixture screws on the secondary side of the carburetor. The adjustment procedure is exactly the same except that all four idle mixture screws are adjusted instead of just two.



On manual or electric choke-equipped carburetors, make sure the choke assembly is in the full off position. Make sure the fast idle speed screw is not touching the fast idle cam to increase idle speed.
